

Europiiisches Patentami Europiean Patent Office

Office suropéen des brevets

(11) EP 0 795 399 A1

(12)

## EUROPEAN PATENT APPLICATION

(43) Data of publication: 17,09,1997, Bulletin 1997/SB (51) Int CI 6: 8328 27/36

(21) Application number: 97103984.7

(cr. c.) a deduction continues ( cas a propose.

(22) Date of filing: 16.03.1897

(84) Designated Contracting States: DE FRIGB IT LU NL

(30) Priority: 12.03,1996 JP 83197/96 11.07.1996 JP 201113/96 15.07.1996 JP 134845/96

(71) Applicant: Diefoil Hoechat Co., Ltd. Tokyo (JP) (72) Inventors:

 Hibiya, Takashi, a/o Distoli Hoechst Co. Ltd. Sakata-gun. Shiga-ken (JP)

Miki, Takatoshi,
c/o Diatolf Hoechst Co. Ltd.
Sekata-pun, Shiga-ken (JP)

(74) Representative:

TER MEER STERMEISTER & PARTNER GbR Mauerkircherstrasse 45 81679 München (DE)

(54) Laminated polyester film

 $\langle 57 \rangle = A$  lamine)ad polyeeter film of the present invertion comprises:

a fine cell-containing polyaeter film comprising 55 to 30 % by weight of polyester and 5 to 45 % by weight of a thermoplestic resin, selid fine cell-containing polyester film having a dentity of 0.40 to 1.30 oten?" and

at least one enoties polyester (lim laminated as an outer-most layer on at least one of auritaces of said fine cell-ordinaring polyester (fin, said another polyester (lim having a classify of not less than 0.40 giorn?. A line cell-containing parentated polyester (lim having a classify of not less than 0.40 giorn?. A line cell-containing taxinisted polyester (lim of the present invention is suitable as printing papers to at lease printer, a color printing and a visitio pather and a noutliff or a sell print.

#### Description

## BACKGROUND OF THE INVENTION:

The present invention relates to a laminated polyester film and more particularly, it relates to a laminated polyester in comprising a polyester layer containing a sufficient amount of firse cells and at least one another polyester layer or laming audistratility no fine cells (hereinafter referred to merely as l'aminated polyester film?) which has a reduced weight per unit volume und a good cushioning property, image-mosiving papers suitable for a laser printer, a color printer and a video printer, and a mount suitable for seal print, which papers and mount are composed of the laminated polyester film.

Biopolally-oriented polyester films have widely used as inclustrial materials because they can exhibit well-balanced various properties or characteristics and are excellent in post performance. Further, this cell-containing polyester films which are proclased as light-weight withis openue than baving a good bushinding property by blending a polyester with a thermoplestic restri immiscible therewith and modifing the resultant bland into a film shape, have been applied, for example, to synthetic papers such as image-receiving popers for a base printer, a color printer or a wideo printer or exident printer or exident printer or exident printer, and the printer or a wideo printer, and the printer of the printer or exident printer or exident printer or exident printers, and the printer or exident printers are used as the image-receiving papers, for enhancing a definition of images formed thereon, while pigments and/or fluorescent while-ening agents are blended in the tilms on as to increase a yelloweres thereof.

Also, the fine cell-containing polyester films have been applied to mounts (release backing paper) unto which an image-printed seal is attended, due to a high custioning property thereot. For instance, the mounts have been used to image-printed seal seal the protocean property the resolution in standard from configuration or background is first selected and then a photograph of a person or persons posed in front thereof is taken by an instant carners, so that many bridge seals can be instantineously produced.

in order to reduce the production cost of such white opeque films, it is required to use white pigments or fluor excent whitening agents effectively.

Further, as is well known in the art, when the fine celf-containing polyester liftms are used as a mount of imagesering papers or printing papers, surface conditions thereof give a considerable influence on an quality of images printed thereon. Specifically, in the case where the film has a rough surface due to the warriness of time cells present in close grownity to the surface, the definition of images printed thereon becomes deteriorated, so that there is caused such an inconvenience that no clear and fire images cannot be obtained.

Furthermore, when the fine cell-containing polyecter film is produced, there arises such a problem that a cast roll, a secretary roll and the like are solled by the immiscible thermoplastic resin present in close proximity to the surface of the film.

As a result of various studies by the present inventors, it has been found that, by laminating another specific polyester layer on at least one of surfaces of the base polyester film containing immiscible thermoplastic rear in a specified range, the obtained laminated polyester film exhibit a reduced weight per unit valume and good cushioning property. The present invention has been attained on the basis of the finding.

## SUMMARY OF THE INVENTION:

It is an object of the present invention to provide a terminated polyenter film comprising a fine cell-containing polyester layer and a polyester layer as an outermost layer, formed on at least one of surfaces of the first cell-containing, polyester layer, which exhibits a reduced weight per unit volume due to a sufficient amount of fine cells contained therein, and an image-receiving paper for a latear printer comprising the laminated polyester film.

It is another object of the present invention to provide a laminated polyaeter film comprising a fine cell-containing polyaeter layer and a polyeeter layer as an outermost tayer, formed an at least one of surfaces of the firm cell-containing polyaeter layer, which exhibits a sufficient surface yellowness at a relatively small amount of the fluorescent whitening agent, and an image-receiving paper for a color printer comprising the laminated polyaeter film.

It is a further object of the present invention to provide a terminated polyecter film comprising a time cell-containing polyecter layer and a polyecter layer as an outermost layer, formed on at least one of surfaces of the time cell-containing polyecter layer, which has no damage to custioning property and prevents the surface contilions of the film from being adversely affected by the waviness of fine cells contained therein, and an image-receiving paper for a video printer comprising the familiated polyecter film, which is cauchted for recording other and fine images thereof the images thereof.

It is a still further object of the present invention to provide a laministed polyester film comprising a firm cell-containing polyester layer and a polyester layer as an outermost layer, borned on at least one of outliness of the first cell-containing polyester layer, which can prevent roll members from being solled during the production process and which can maintain a good flexibility by adjusting a radio between thicknesses of both the layers to a specified range, and a recard for seal print corrobing the laminister polyester film, which can exhibit no shattered surface and a good flexibility.

To accomplish the aim, in a first aspect of the present invention, there is provided a terrinated polyester film com-

printing a fine cell-containing polyecter film comprising 55 to 95 % by weight of polyecter and 5 to 45 % by weight of a thermoplastic restriction sine cell-containing polyecter layer having a density of 0.40 to 1.30 g/cm<sup>2</sup>, and an another polyecter layer having a density of not less than 0.40 g/cm<sup>2</sup>, familiated as an outermost layer, on at least one of surfaces of said the cell-containing polyecter film.

In a second aspect of the present invention, there is provided a liaminated polyester film comprising a fine cell-containing polyester film comprising S5 to 95% by weight of polyester and 5 to 45% by weight of a thermoplastic resin, the fine cell-containing polyester layer naving a density of 0.40 to 1.30 g/cm<sup>2</sup>, and an another polyester layer having a density of 0.40 to 1.30 g/cm<sup>2</sup>, and an another polyester layer having a density of 0.40 g/cm<sup>2</sup>. It and an another polyester film 0.40 g/cm<sup>2</sup>, iteminated as an outermost layer, on at least one of surfaces of said fine cell-containing collection.

wherein the said another polyecter film contains not less than 0.01 % by weight of a fluorescent whitening agant, whose consentation is higher than that is the fine cell-containing polyecter film, and 0.3 to 30 % by weight of a white pigmant based on the total weight of the another polyecter film, the yellowness on a surface of said another polyecter film is not more than 4.5 and the potical density of said another polyecter film is not less than 0.5.

In a third aspect of the present invention, there is provided a laminated polyester film comprising a fine cell-containing polyester film comprising 55 to 95 % by weight of polyeeter and 5 to 45 % by weight of a fibre-mapsissio resin, the fibre-cell-containing polyeeter (signer having a density of 0.40 to 1.30 g/cm², and an another polyester layer having a density of 0.40 to 1.30 g/cm², and an another polyester layer having a density of 0.40 g/cm², taminated as an outermost layer, on at least one of surfaces of said fine cell-containing polyester film.

wharmin the trackness of salid another polyester film is represented by the formula (1):

$$0.056 \le T_R \le 36 \tag{1}$$

where T<sub>0</sub> represents a thickness at the another polyester film after stretching and d (µm) represents an average particle dismoster of the dispersed particles of the thermodestic resin, contained in an unstratched sheet.

In a fourth aspect of the present invention, there is provided a laminated polyester film comprising a fine cell-conairing polyester film comprising 55 to 95% by weight of polyester and 5 to 45% by weight of a thermoplastic resin, the fine cell-containing polyester layer having a density of 0.40 to 1.30 g/cm², and an another polyester layer having a density of not less than 0.40 g/cm², laminated se an outermost layer, on at less one of surfaces of said time cell-containing polyester film.

wherein the ratio of the thickness of said line cell-containing polyaster film to the thickness of said another polyexter layer is recreasined by the formula (2):

$$10 \le T_A/T_B \le 500$$
 (2)

where T<sub>A</sub> represents a trickness of the fine cell-containing polyacies film and T<sub>B</sub> represents a total thickness of said another polyacitar layer.

in a little appeal of the present invention there is provided a trage-receiving paper for a laser printer, comprising the luminated polyester film defined in the first expect.

In a sixth aspect of the present invention there is provided a image-receiving paper for a color printer, comprising the laminular polyecter film defined in the second aspect.

In a several aspect of the present invention there is provided a image receiving paper for a video printer, comprising the iaminsted polyecter film defined in the tritid aspect.

in an eighth aspect of the present invention there is provided a mount for seal print, comprising the laminated polvester film defined in the fourth aspect.

## DETAILED DESCRIPTION OF THE INVENTION:

The present invention is described in defail below. The laminated polyaster film according to the present invention continues a time cell containing polyaster film (a layer) and an enotine polyaster film (B layer) saminated as an outermost layer, on at least one of surfaces of the said line cell-containing polyaster film (A layer).

Polyesters as raw materials of the terminated polyester film according to the present invention may be those propagation as a summatic discribosylic acid or an select thereof and is glycol as primary starting materials, and having repeating units comprising not less than 30 % of eithylene target/thistate units or eithylene-2, 8-naphthalate units. Furfies, the polyesters may contain the third component unless the content thereof departs from the albre-mentioned range.

Examples of the suitable aromatic dicarboxylic acids used for the production of the polyester may include terephilibrac acid, 2,4-may this lene dicarboxylic acid, scophilasic acid, phihalic acid, acipic acid, sebedic acid, poyarboxylic acid such as p-cyclehoxy-aromatic acids exch as p-cyclehoxy-aromatic acids or the line. These aromatic acids can be used singly or in the form of any two or exercities acid. Examples of the suitable glycole used for the production of the polyester may include athy-

ens glycol, distingtens glycol, propylens glycol, butane diol, 1, 4-cyalahaxains dimethanol, necpentlyi glycol or the like. These glycols can be used singly or in the form of a mixture of any two or more thereol.

The A layer according to the present invention has a density of generally 0.45 to 1.30 g/cm<sup>2</sup>, prelentably 0.60 to 1.20 g/cm<sup>3</sup>, more prelentably 0.70 to 1.10 g/cm<sup>3</sup>. When the density of the A layer is more than 1.30 g/cm<sup>2</sup>, this amount of final cells in the A layer becomes too amalf, so that cushioning property or paper feeling which are fastures of the faminated polyecter film according to the present invention is apt to be damaged. On the other hand, when the density of the A layer is less than 0.40 g/cm<sup>3</sup>, the surface of the film is rendered extremely rough so that the quality of images formed on the film is thely to be deteratorated.

The B tayer ringy contain any optional number of fire cells or almost no fine cells. The density of this B layer is generally not less than 0.40 g/cm<sup>3</sup>, preferably in the range of 0.80 to 1.50 g/cm<sup>3</sup>. When the density of the B layer is generally not less than 0.40 g/cm<sup>3</sup>, the surface of the B layer is rendered extranely rough so that when a familiated film described in detail hereinefter is applied as an image-receiving paper, lealing of the images printed thereon is damaged and, therefore, the custof whence the access to the access the access the access the access the access the access to the access the access the access to the access the access to the access to the access the access that access the access to the access the access to the access that access the access to the access the access to the access that access the access that access the access than 0.40 g/cm<sup>2</sup>.

The polyester used for the A layer has an intrinsic viscosity of generally 0.45 to 1.0, preferrably 0.65 to 1.0 when mountain the interest of the A layer is less than 0.45 to 1.0 when resultant film tends to suffer from breakage or rupture upon the film formation and further it is difficult to control the density of the A layer because the size of closed calls formed therein becomes uneven, resulting in deteriorated productivity. On the other hand, when the intrinsic viscosity of the A layer is nor than 1.0, the resultant film of the A layer has a low stretcheshipt so that there is a fundancy that the amount of closed cells formed in the A layer is is sufficiently.

The polyaster used in the B layer may have an intrinsic viscosity identical to or different from that of the polyaster used in the A layer. However, it is preferred that the B layer as the outermost layer have a higher intrinsic viscosity time that of the A layer as an inner layer. This is because any breakers or repture of the tilm is prevented from being caused during the film intrinsicion process and failing off or separation of particles from a surface of the tilm is untillety to occur.

In accordance with the present invention, in order to incorporate fine cells into the A layer, the thermodisatic resin immiscible with polyecter is used. That is, in the filtr-harming process described in detail hereinable, the immiscible thermodisatic resin blanded in polyecter is, present in the form of dispersed particles when formed into an unstretched sheet, and thereafter, fine cells are produced in the A layer when the sheet is stretched.

Examples of the afore-mentioned thermoplastic resine involvable with polyester may include polyalistins such as polyethylene, polypropriene, polymetry pertiene or polymetry buttere, polystyrane, polycarbonates, polyprientyl suillides, liquid crystal polyesters or the life. Among them, polypropylene is preferably used from the standpoints of the production cost or the productivity.

Preterved polypropylense are crystalline polypropylene homopolymers having usually not less than 35 mol %, preferably not less than 36 mol % of propylene units. In the case where non-crystalline polypropylene is usual as the instrucible thermopoletic resin, the bleed-out of the polypropylene is caused on a surface of an amorphous polypeter direct, so that a cooling drum, a stretching roll or the like is got to be soiled therewith. Also, if the polypropylene is copolymerized with more than 5 mol % of other units their propylene, e.g., ethylene units, there is a tendency that the amount of closed-calls may be formed in the polyseter in insufficient.

The melt flow index (MFI) of the afore-mentioned polypropylene is usually in the range of 0.5 to 30 g/10 min, protistry 1.0 to 15 g/10 min. When the melt flow index of the polypropylene is less than 0.5 g/10 min, the size of the calls formed may become too large so that breakled por rupture of the resultant flow may be likely to be caused upon stretching. On the other hand, when the melt flow index of the polypropylene is more than 30 g/10 min, clips of a tenter used as a stretching apparatus may be tently to release from the film, or the cleraky of the film may be rendered non-uniform with elabored firm and, the retor, may become difficult to control, resulting in deteriorated productivity of the film.

The amount of the immiscible thermoplastic reain contained in the polyecter is in the range of 5 to 45 % by weight, prost prefearably 5 to 55 % by weight, most preferably 10 to 25 %, all more preferably 10 to 25 % by weight, most preferably 15 to 25 % by weight based on the total weight of the polyecter and immiscible thermoplastic resin contained in the polyecter is less than 5 % by weight, those the amount of the timescribe thermoplastic resin contained in the polyecter is less than 5 % by weight, the cannot exhibit a sufficiently reduced weight are good custioning property. On the other hand, when the amount of the immiscible thermoplastic resin contained in the polyecter is never then 45 % by weight, the surface roughness of the resultant filth becomes too large.

The fine sells in the A layer can be produced by stretching an unstretched sheet containing dispersed particles made of the immiscible thermodestic resin, in at least one direction. According to howeverige of the present inventors, the size of the fine cells in the A layer and the waviness on a surface of the A layer and varied depending upon an average carticle claimater (d) of the above mentioned discovered particles of the inmiscible thermodestic resin.

The alone-mentioned dispersed particles of the innivisible thermoplastic rasio are produced by the granulation of the innivisable thermoplastic resion are produced by the granulation of the innivisable thermoplastic resin are produced to the energy particle dismater of the dispersed particles of the innivisable thermoplastic rasin can be controlled by changing a blanding ratio of the innivisable thermoplastic rasin can be controlled by changing a blanding ratio of the innivisable thermoplastic ratio of the little.

identified the dispersed particles in the unshetched sheet are of substantially a opherical shape and thereaffer, undergoes the disportance of information of their shapes when subjected to businequent filler-formation process including stetching and heat-freeting steps. That is, after adejocited to the stretching and heat-freeting steps. That is, after adejocited to the stretching and heat-freeting steps. That is, after adejocited to the stretching and heat-freeting steps, the disported particles in the layer A are present at a periohenty of each of the fine poils and deformed into an ellipsoidal shape, a flet chape or the invested filler are contable and measurable. Accordingly, by separating the disported particles in the layer A, and researched the turnbur of the disported particles and the charity thereof par a predetermined weight, an average volume of one disported particle can be determined. This enables the everage particle staneals of the spherical dispersed particles of the particles of the particles of the spherical dispersed particles of the particles of the particles of the spherical dispersed particles.

In accordance with the present invention, in order to control the size of the fine cells formed in the film-forming procer interesting steps to that the density and custioning property of the system A is adjusted to respective required ranges. It is presented that a surfactant be incorporated in the polysetor as a new material for the A layer.

Exemples of the suitable surfactants may include enriche suitablants, cathoric surfactants, amphoteric surfactants or the like. Among them, the nonionic surfactants, especially the alticone-based surfactants are preferable. Specific examples of the silicone-based surfactants may include organizely subcarne-polymographysic compolysistens of polymographysistens, or the like. The amount of the surfactant contained in the perspective of the silicone polymographysistens, or the like. The amount of the surfactant contained in the polyester is generally in the range of 0.001 to 1.0 % by weight, nesterably 0.01 to 0.5 % by weight, Whan the amount of the surfactant is more than 1.0 % by weight, when the addition of the surfactant can no longer be increased and there is a tendency that some throubles of the adductor used or deterioration in quality of polyester or the like case by a reused.

Also, in accordance with the present invention, under the consideration of advantages of reducing the cost for rew materials and an environmental protection, in order to decrease an amount of film scraps which are discharged from a process for the production of films, the A layer may be produced by using both a reclaimed polyseter and a virgin polyecter are retained polyseter.

Buch a reclaimed polyester may be contained in the rew polyester in an amount of 5 to 90 % by weight. The reclaimed polyester unable for this purpose may include, for example, reclaimed polyesters recovered from a base film of a rescanded card, PET bothes or the file, polyester scrape obtained by a direct polymerization process, or the life.

Equacially, in the present invention, since the fine cell-containing polyester film (A layer) is covered with another polyester film (B layer), octored reclaimed polyester may be used as far as the color thereof can be corrected subsequently. As discussed above, expendy what range of polymers can be used as the raw polyester for the A layer, which leads to such as advantage that the laminated polyester film can be produced with a low production cost by using the reclaimed bothstars or the file set the team polyester film can be produced with a low production cost by using the reclaimed bothstars or the file set the raw polyester for the A layer.

The abre-mentioned reclaimed polyesters is usually pulverized and then melt-extruded into reclaimed chips. However, the reclaimed polyesters are not necessarily onlipped but can be directly fed into a twin-sorre extruder equipped with a verif society with viewin polyester after pulverization.

Further, as such radaimed polyeeters, there may be used trimmed film scraps discharged from the process for the production of fire cell-containing polyeeter films or fine self-containing laminated polyeeter films in which laminable thermolester regin is between.

In accordance with the present invention, the amount of the reclaimed polyester used as the raw polyester of the A layer is at the range of 5 to 80 % by weight, preferably 15 to 50 % by weight, more preferably 30 to 40 % by weight, based on he total weight at polyesters used in the A layer. When the amount of the reclaimed polyester used is less than 5 % by weight. The effects of reducing the cost for the raw meterials cannot be sufficiently attained. On the other hand, when the amount of the reclaimed polyester used is more than 0.5 % by weight, it is difficult to correct a color for the resultant film. Whereas, the amount of the virgin polyecter used as the raw material is in the range of 40 to 55 % by weight, preferably 50 to 85 % by weight, more preferably 80 to 70 % by weight based on the total weight of polyecters used in the A layer.

In acciditors, in accordance with the present inventions, the branded polyester comprising the reclaimed Polyester and the virgin polyester has an intrinsic viscosity of 3.45 to 0.72, preferably 6.55 to 9.69, more preferably 0.55 to 0.65 when the strender polyester is an applicable into a film. When the intrinsic viscosity of the blanded polyester is out of the afore-menioned carge, a film begins a sufficiently reduced weight and sufficiency produced carging and carboning good carboning property may not be obtained.

It is preferred that, expecially when applied to image-receiving papers, the laminated polyester film according to the present invertion can exhibit a high optical density from the standbolk of enhancing a delimition of images. Such a high optical density can be imparted by incorporating pigments such as titanium dioxide, bantum suitate or the like into the A large.

Any two or more of these pigments can be incorporated in the A layer. In this case, it is preferred that at least litter must disorde or barkum softiate be contained in the A layer. The average particle diameter of the alone mentioned pigments of percentify on more than 5.0 µm, preferredly in the range of 0.0 to 0.0 µm. When the average particle diameter of the pigments is more than 5.0 µm, have may also problems that the surface roughness of the film is too large, so that the quality of images principed on this film is deteriorated.

The amount of the pigments contained is generally in the range of 0.8 to 0.9 % by weight, preferably 1.6 % to 15 % by weight, more preferably 1 to 5 % by weight based on the weight of the Aleyer. When the amount of the pigments contained is less than 0.3 % by weight, the laminated polyseler film may have an insufficient yellowness as a whole, or that the quality of integes printed thereon, especially contains to definition thereof, is dejeriorated. On the other hand, whon the amount of the pigments contained is more than 3.0 % by weight, there may arise profittens that the pigments are congulated to form large prorusions, in the case where two or more pigments are used, the total amount of the pigments is a formed and of the pigments are congulated to the aforemental to so controlled to the aforemental news.

In accordance with the present invention, the pigment may be added to a reaction system during the synthesis of the A layer or directly to the polyester produced. In the case where the pigments are added during the shift-head of the 70. A layer polyester, it is preferred that a sturry prepared by dispersing the pigment in ethylene glycol or the filter may be added in an optional stage of the synthesis of the A layer. On the other hand, in this case where the pigments are directly added to the polyester produced, it is preferred that a dry powder or a sharp prepared by dispersing typinants in water or an organic solvent having a boiling point of not more than 200°C may be added to the A layer polyester by using a technique and refer.

In order to control the amount of the pigments contained in the Aleyer, it is usable a melthod in which a master raw material containing a high concentration of pigments is prepared according to the afore-mentioned process and the master raw materials distinct with a raw material containing substantialty no pigments upon the fillrefurning process. Incidentally, the pigments may be subjected to pretrestments such as crushing, dispersion, classification, fillrefitor or the fillrefit required.

Also, it is preferred that, especially when applied to image-receiving papers, the laminated polyester firm according to the present invention has a high yellowness from this standpoint of a christoning a definition of images printed thereon. The yellowness of the laminated polyester film ecosoling to the present invention can be represented by a by value. The bivalue is preferably not more than 1.0, more preferably not more than 1.5. When the bivalue is more than 1.9, the color tone of the laminated polyester film may give an adverse influence on that of images printed thereon and, therefore, the film may have a determinated polyester film may give an adverse influence on that of images printed thereon and, therefore, the film may have a determinated polyester.

20

The yellowness of the terminated polyecter film according to the present invention can be decreased by incorporating a fluorescent whitening agent to the taw polyecter of the A layer. The protected buchecard whitening agent as the Teleffect (produced by Chief Gelgly AQS, "OB-1" (produced by Chief He lies", Einfarch, the law-instead polyecter film according to the present invention has pretently a cybical density of not less than 0.3, more preferably not less than 0.5. What the optical density is less than 0.5, the laminated polyecter film such have preferably not less than 0.5. What the optical density is less than 0.5, the laminated polyecter film such have an intuiticient light-shelding property, so that the distribution of images printed on the film may be detained.

The terminated polyester film according to the present invention may be produced usually by termineting enother polyeeter film (8 layer) containing substantially no fine closed cells on the fine cell-containing polyester film (A layer) using a co-extructing nethor. More specifically, the raw meterials for the respective layers are first melted in separate worlders and then the molten new materials are introduced into a common die in which both the layers, which is mentalmed in a molten state, are larminated one over another and extruded through a sit-like opening to form a terminated sheet. Thereafter, the larminated sheet is subjected to stretching and healt-insating steps.

In the leminated polyester fifth according to the present invertion, it is required that only the fine cell-confisiting polyester film satisfate the requirements concerning the intrinsic viscosity of the polyester and the amount of the immiscible thermoplastic resin added, incidentally, in accordance with the present invention, appropriate additives such as an anti-coldizing agent, a heat stabilities, a buhicant, an anti-statio agent, dyes, pigments or the liter may be Mended in the polyester or the intermoblastic resin, if required.

on The total thickness of the learninged polyecter film according to the present invention is generally in the range of 20 to 250 jurn, prelerably 20 to 125 jurn. The thickness of the A layer is generally not less than 20 %, preferably in the range of 50 to 59 % based on the long thickness of the laminated polyecter film. When the thickness of the A layer is less than 20 %, the resultant laminated polyecter film cannot satisfy the requirements such as radiused weight or good cathlondor property.

The laminated polyecter film according to the present invention can be applied to labels, recording papers, posters, posters film according to that present invention can be preferably used as image-receiving papers for a label printer.

Thus, the image-receiving papers for a laser printer according to the present invention comprise such a fine callcontaining terminated polysater film. The image-receiving papers according to the present invention are excellent in defintion of the images printed thereon, and free from solds on the images printed and jamming upon paper-feeding, and can be produced with a two cost.

hiera, terminated polyester times according to other preferred embodiments of the present invention are explained helicer.

Also, a first laminated polyester tilm (harelmatter raterned to merelly as Taminated film (§)") is such a laminated film comprising the layer A and as the 8 layer, a polyester layer which contains a high concentration of the fluorescent whileenting agent and a specific constratation of the white pigments (hereinater reterned to merelly as "E;" layers. In the laurisment film (f) succording to the present invention, it is preferred that the concentration of the filter version authorizing against in the 9-layer via an outcommost layer is not less than 0.01 % by weight and higher than that in the A layer, and the concentration of the whete pigments in the B, layer is in the range of 0.0 to 30 % by weight. Further, it is preformed that a curious of the B, layer exhibits the B value of not more than +3.0, and a optical deneity of not less than 5.2. When the 5 value is more than +3.0, the color tone of the B, layer is agit to advantage affect a color tone of the images printed thereon. The b value is more preferably not more than +3.0, till more preferably affect double for the order of the images printed may be deteriorated due to the teck of light-shielding proportions so that the terminated polyecter film may be deteriorated in suitability for image-receiving papers. The optical deneity is taken to the contract of the contract

When the encount of the fluorescent whitehing agent contained in the B<sub>1</sub> tayer is less than 0.01% by weight, it is before the other processor of the state of th

The arrount of the fluorescent whitening agent contained in the 8, layer is still more prelierably in the range of 0.04 to 0.0% by weight, it is still more pallered that the relationship between the concentrations of the fluorescent whitening agent contained in the 4 terms and 8, layer is represented by the format:

(Concentration in the B , layer (% by weight)) > (Concentration in the A layer (% by weight)) + 0.03 (% by weight).

When the amount of the white pigments contained in the B<sub>1</sub> layer is less than 0.3 % by weight, there may be a Bioline shorter-specified optical density cannot be achieved. On the other hand, when the amount of the white pigments is never than 30 % by weight, there may arise such a problem that particles of the white pigments may be occeptated to from larger protrusions on the surface of the film. In the case where two or more tinds of white pigments are used it is preterred that a total amount of the white pigments is so controlled as to lie within the above-specified larger.

The amount of the white pigments contained in this E<sub>1</sub> tayer is more prefer ably in the range of 0.5 to 20 % by weight, all more preferably 1.0 to 20 % by weight. In this case, if two or more binds of white pigments are used, the obligation of the white pigments are used, the obligation of the white pigments is a size adjusted are as to lie within the above-specified preferred ranges. Examples of the suitable white pigments may include thanking displayments are preferably selected from titanium displayed and because of the white pigments to preferably selected from titanium displayed and because white pigments and the preferably selected from titanium displayed and because which is a selected from titanium displayed and because of the white pigments to preferably selected from titanium displayed and the preferable preferably selected from titanium displayed and the pigments to preferably selected from titanium displayed and the pigments that the preferably selected from titanium displayed and the pigments to preferably selected from titanium displayed and the pigments to preferably selected from titanium displayed and the pigments to preferably selected from titanium displayed and the pigments to the preferably selected from titanium displayed and the pigments to preferably selected from titanium displayed and the pigments to the pigments to the pigments the preferably selected from titanium displayed and the pigments to the pigments to the pigments the preferably selected from titanium displayed and the pigments the pigments

The everage particle diameter of the white pigments is preferably not more than 5.0 µm, more preferably in the range of 0.5 to 3.0 µm. When the average particle dismeter of the white pigments is more than 5.0 µm, the surface roughness of the terminated film (§) may be too large, so that there may arise problems such as the destoration in quality of the insuges pointed thereon, the falling-off of the white pigments from the surface of the faminated film (§) or the like.

In secondarice with the present invention, the additives such as the fluorescent whitening agent or the white prigrection may be added to a reaction operate additive, the synthesis of polyseler or may be directly added to the polyseler produced, in the case where the additives are added during the synthesis of polyseler, it is preferred to add at an optionis steps of the synthesis in the form of a stury prepared by dispersing the additives in strylers glycol or the like. On the other hours, it this case where the additives are directly added to the polyseter produced, it is preferred to add in it has horn of a dry powder or a stury prepared by dispersing the additives in water or an organic polarin having a bothing point of only more than 2007. Such dry power or stury may be blended with the by using a twin-scree we childer.

In quiser to control the amount of the additives added, it is usable a method in which a master raw metarial containing in thigh conventration of the additives in prepared according to the above membraned process and then the missier raw material is diluted with a raw meterial containing subclantially no additives when being shaped into a liter, incidentally, the write pigments may be subjected to prefreatments such as crushing, dispersion, disselfication. Ritration or the like, it required. Purpher, in accordance with the present invention may other additives such as an artification graph, a frest stabilizer, an artificiation agent, divers, pigments or the like may be blended in the polyecter or the polypropylene, if required. Purpher

The luminated (lim (f) according to the present invertion can be applied to labels, recording papers, posters, plantplant, printing plates, exapping materials or the line in view of its accellant properties. Especially, the laminated (lim (f) according to the oreant invertions can be preferably used as snage-receiving papers for a color printer.

Thus, the image-receiving papers for a color printer according to the present invention comprise such a taminated territy a which the 6 years as an outermost layer functions as a printing surface The image-receiving papers for a color printer according to the present invention are excellent in consentration and definition of the images printed thereon, and time from which on the images printed thereon, and time from which on the images and immains uson paper-feeding, and can be produced with a low cold.

Further, a liminated polyecter film (hereinafter referred to merely as "aminated film (II)") is such a terrinated film (concrision, the layer A and agifte B layer, a polyecter layer having a specific relation between an average particle diam-

eter of dispersed panicles made of the thermoplastic resin immiscible with polyester in the layer A of an unstratched sheet and the thickness of the B layer (hereinafter referred to merely as "B<sub>2</sub>" layer).

In the territant of third (I) according to the present invention, the B<sub>2</sub> layer as an outermost styer is required to subtisy a practical mixed relationship between its thickness and the address-manifold everage particles made of the thermoplastic resin immiscible with polyester in the layer A of an unable cloth sheet so as not to be advarsely effected by the warrings on the surface of the A layer as an inner layer. That is, it is accordance with the greater invention, it is necessary that the B<sub>2</sub> layer calefilies the condition represented by the formula.

more preferably 0.1d ≤ T = ≤ d.

still more preterably 0.1d = T a = 0.5d

wherein dispresents an average particle diameter ( $\mu m$ ) of the dispersed particles and  $T_B$  represents a trickness ( $\mu m$ ) of the  $B_2$  layer after stratching.

When the thickness E<sub>2</sub> of the B<sub>2</sub> layer is less than 0.05d, the surface of the B<sub>2</sub> layer may not be sufficiently provented from being adversely effected by the warriness on the surface of the A layer. On the other hand, when the thickness T<sub>3</sub> of the B<sub>2</sub> layer is more than 3d, the faminated tilm (It may exhibit insufficient cushioning property, and especially may be short of a suitability for image-receiving papers.

The density of the B<sub>2</sub> layer is varied by the addition of this white time particles, but may be controlled us as to fis preteably in the range of 1.30 to 1.50 glorn\*, more preteably 1.35 to 1.50 glorn\*. When the density of the B<sub>2</sub> layer is less than 1.30 glorn\*, there may be a handency that the surface roughness of the B<sub>2</sub> layer becomes large, so that in the case where the laminated tilm (II) is intended to be used as an image-receiving paper, feeling of the images printed thereon may be destroited.

The surface roughness R<sub>0</sub> of the 8<sub>0</sub> layer as an outsermost layer of the laministed film 18) according to the present invention is varied depending upon the amount of time calls in the A layer, the thickness of the 8<sub>0</sub> layer, the amount of the white fitter particles added or the line but reay be controlled so as to lie prelarably in the range of 9.08 to 9.80 µm, note prelarably 0.10 to 9.20 µm. When the surface roughness R<sub>0</sub> is less than 0.06 µm, the surface of 10.88 to 9.80 µm, note prelarably 0.10 to 9.20 µm. When the surface of the farmen may be likely to suffer from voids. On the other hand, when the surface roughness R<sub>0</sub> is more than 0.30 µm, the surface of the farminated film (ff) may become too rough, so that there may be a tendency that the images printed thereon have a low concentration.

In the case where the laminated film (II) according to the present invantion is used as an image-receiving paper (printing paper), it is preferred that the laminated film (II) has a good yellowness and a high optical density from the standpoint of enhancing the definition of the images printed thereon. The optical density of the laminated film (II) is preferably not less than 0.3, more preferably not less than 0.5. When the optical density of the laminated film (II) is less than 0.3, the light-chickling properties thereof may be insufficient so that the definition of the images printed thereon may be deforted to.

The yellowness of the laminated film according to the present invention can be represented by the 5 value of (1, a, b) which is a color specification according to JIS Z-8722. The 8 value of the laminated film (8) is preferably not more than 4-3.0, more preferably not more than 4-3.0, still more preferably in the range of 5.5 to 1.0. When the 8 value of the laminated film (8) is more than 4-3.0, there may be a tendency that the color tone of the images printed on the film may be deteriorated.

The optical density and the yellowness of the laminated film (ii) can be controlled by adding the white pigments to the By styre constituting the laminated film (ii). Further, the yellowness of the laminated film (ii) can be increased by adding the transcript whichers agent therefore a per therefore the transcript of the processor whichers agent therefore.

As the white pigments and fluorescent whitening agents for the laminated film (II), there can be used those white pigments and fluorescent whitening agents described in the laminated film (I). The amounts of the white pigments and far the fluorescent whitening agents contained in the lam — I shall fill may be the seame as those to the size — remissioned laminated film (I). Further, in order to anharize the opprenting may be added to the A layer. In this case, the — out of the white pigments added to the A layer may be preferably in the trapped fluored for \$2.5 by weight. Those creates when the pigments added to the A layer may be preferably in the trapped fluored fluore

The lamineted film (if) according to the present invention can be applied to labels, recording papers, postare, plecographic printing plates, wrapping materials, tags or the like Especially, the laminated tim (if) according to the present invention can be pretentiby used as inege-receiving papers for a video printing.

Furthermore, a laminated polyester film (hereinafter reterred to merely as "laminated film (III)" is such a laminated film (III). It is such a laminated film (III) is such a laminated film (III). It is such a laminated film (III) is such a laminated film (III). It is such a laminated film (III) is such a laminated film (III).

in the terminated film (III) according to the present invention, it is preferred that the ratio (T<sub>M</sub>T<sub>BB</sub>) at a film thickness

Fig. of the A layer for in total film thickness Tigs of the Big layer(6) is in the range of 10 to 500. The A layer comprises 5 to 40 ft by vesight of the Bismonolated reals invariable with polystater and hear a density of 0.4 to 1.50 g/cm², thereby achicking a variable in heart billing and the second of the s

This  $\mathbb{B}_2$  layer of the laminated film (iii) may be a layer which contains substantially no thermoplistic reast immiscible with the first the density of the  $\mathbb{B}_2$  layer is preferably not less than 1.30 g/cm², more preferably in the range of 1.35 to 1.50 g/cm².

This surface roughness R<sub>o</sub> of the B<sub>2</sub> layer as an outermost layer of the terrinated film (III) according to the present investion is preferably not less than 0.05 µm, more preferably in the range of 0.10 to 0.50 µm. When the surface roughness P<sub>o</sub> is less than 0.05 µm, the surface of the terrinated film (II) may be axcessively flattened so that the surface conditions of the terrinated film (III) considerably departs from the testing of pages.

It is protented that the terminated film (III) according to the present invention exhibits a good yellowness and a hightic control density to impart a high-grade appearance to the film product especially when applied to a mount (release backing perior) for each print.

Specifically, the cytical density of the terrenated film (18) according to the present invention is preferably not less than 0.5, incre preferably not less than 0.5, when the optical density is less than 0.5, the light-shielding properties of the learning till milk the processor issufficient as that the film may show a destroited substitutibility for seal printing.

The yellowness of the terminated film (III) according to the present invention can be represented by the B value of (L. a, 5) which is a color specification according to JIS 2-8722. The b value of the terminated film (III) is preferably not more than 43.0, more preferably not more than 4-10, still more preferably in the range of 4-0, for 1-10. When the b value of the terminated film (III) as more than 4-3.0, there is a tendency that the color tone of the mount may be adversely affected; resulting in carmage to a high reside appearance thereof.

in order to enhance the optical density and the yellowness of the leminated film (III), the  $B_3$  layer can also contain will prigners which are the same as or different from that in the A layer. The amount of the write pigments contained in the  $B_3$  layer may be in the range of 0 to 20 % by weight, preferably 1.0 to 20 % by weight, more preferably 1.0 to 15 % by weight. more preferably 1.0 to 15 % by weight.

The emburite of the fluorescent whitening agent to be contained in the respective layers of the faminated film (III) may be determined separately. When the concentration of the fluorescent whitening agent in the B<sub>2</sub> layer is higher than the in the A layer, the amount of the fluorescent whitening agent contained in all the layers of the faminated film (III) can be suitably reduced and, therefore, the efficiency of utilization thereof can be enhanced. The suitable amount of the fluorescent whitening agent contained in the B<sub>3</sub> layer is preferably in the range of 0 to 0.30 % by weight, more preferably 0.4 in 5.0% by weight.

The faminated film (III) according to the present invention can be applied to image-receiving papers for printers, liabels, recording papers, postere, plenographic printing plates, wrapping materials, tags or the like due to its excellent properties. Especially, the faminated film (III) according to the present invention is suitably used as a mount for seal print.

As the white pigments and the fluorescent whitening agents usable for the laminated film (III), the same materials as described for the laminated film (I are exemplified.

In accordance with the present invention. In order to enhance a printability of the laminated film, the layer therach may be subjected to various surface treatments. Examples of the suifable surface treatments may include a coefing treatment, a flame treatment, a plasma treatment, a corona discharge treatment, an utraviolet-invadiation treatment, an ine-planing treatment or the file. These is betterents can be conducted in any optional stage of the process. Among them, the coeffing treatment is present and example the coeffing treatment permits an coeffing type they having an externelly entail trickness to be formed on the laminated film without damage to the unique feeling thereof, or it permits an appropriate courser measure to be created is taken in order to enhance the printability depending upon the applications thereof.

Any materials can be treely used as the components of the coating layer formed on the terminated film as far as the resented itemseted film can eatisty the alone-mantioned specific film properties according to the present invention. Exemplies of the suitable materials for the coating layer may include thermoplastic resins, cross-landable resins or comceptions containing various additives.

Schediffic examples of the suitable thermoplastic resins or cores-invable resins for the coating layer may include her moplastic polyecters; water-dispersible thermoplastic rasins having a sulforate group or the tike; allyd-based polyeating, organic activent-spublic or water-dispersible polyectritere resins; polyisocyamate compounds; polyectratine resrinc having blocked terminal groups; organic solvent-soluble or water-dispersible winyt-based resins auch as very having-my acceptable cases. A property of the property or acryl-based resure; apoxy resins; silipone-based resins; urse-based resure; metamine-based resins; or the life;. Examples of the suitable additives may include dyes, pigments, lichricants, ani-oxidizing agents, utiliserated absorbing aposts, anti-dating agents, incorpanie (ine particules, surfactants or the life;

Any known coaling apperatuses can be used to form the coaling layer on the laminated film. Examples of the pieierred coating apperatuses may include noti-type coaters such as a reverse-roll coater, a gravure coater, a kiss-roll coater or the life, though not restricted file-reto.

The thickness of the coating layer may be varied appropriately. In accordance with the present invention, in order to maintain the unique heeting of the laminated film without damage thereto, the thickness of the coating layer is preleviably in the source of 5.00 to 2.00 cm, more preferably 0.01 to 1,400 till more preferably 0.01 to 0.5 ism.

The coaling layer may be produced either at the final stage of the film formation or during any process by the production of the terminated film. In the latter pase, a coating material may be applied to a surface of the film after it is critical, and the coaling material is stated, and the terminates discribing white the coaling material is still kept in a well state, and then subjected to the heat treatment. Such a method is solventageous from the standpoint of the reduction in production gost thereof because the film formation can be concluded discribing-ously with the coating and drying processes.

Next, the process for the production of the faminated polyester film according to the present invention is described in detail below.

These laminated polyecter tilm according to the present invention can be usually produced by a co-extrusion method in the following namer. First, the raw materials having the compositions for the respective legislate are full into corresponding individual extruders constituting a co-extrusion. Specifically, depending upon the airmed layer structure of the laminated polyecter tilm, raw material resins for the respective layers are charged to two or more extruders which are arranged consipporting to the number of the layers to be formed. The raw material resins are then nested and kneeded in the respective extruders every line. Thereafter, the motion resins are introduced into a two or more-leyered multi-mentiod or feed block and there actuated through a fell in the form of a motion sheet. The conditions the three are mentioned mething and kneeding processes can be controlled depending upon the everage particle dismeter of the dispersed perfuses much of polyecter-immisciple thermopleatic resin, which particles are to be dispersed as he alver.

For example, in the case where the atmed layer structure of the familitated polyester film is BARS, the respective raw materials for the A and B layers are melt-extructed through two expanse extructors and then the melt limb for the B layer can be divided into two melt sub-thes of the course thereof. A metering feeder such as a genr purity in a ranged on each of the divided melt sub-times to control a polymer flow rate for each of the B layers to be leminated over copposite surfaces of the A layer. The thickness of each B layer can be controlled by the optime flow rate. As a matter of course, the metering feeder can be provided on a melt file of the B A layer to effectively control at bildness shareof.

Next, the molten laminated sheet extructed from the clie is republy cooled to a temperature below a glass transition temperature thereof on a rotary cooling drum to form a substantially amorphous unstratched sheet, in this case, in order so can'eve an increased rapid booling of the laminated sheet, it is required to enhance the adhesion between the laminated sheet and the rotary cooling drum. To this aim, in accordance with the present invention, an electrocastic printing neathed and/or a Equil-Cooling printing enthol are orderably adopted.

The electrostatic priming method generally means a method in which a wire electrode is disposed over an upper surface of the laminated sheet so as to extend in the direction perpendicular to the feed direction of the terrinated sheet, and a D.C. voltage of about 15 for about 15 fV is applied to the wire electrode to produce a static charge on the terrinated sheet, thereby enhancing the adhesion between the terrinated sheet and the rotary cooling drum. On the other heard, the found-coeffing priming method researce a method in which the achiesion between the laminated direct and the rotary cooling drum is enhanced by coating a liquid on a part (for example, only surface regions which come into contact with opposite peripheral edges of the laminated sheet) or a whole of an outer surface of the colary cooling drum. In the present invertion, both the methods may be used in combination, if required,

Successively, the thus-obtained unstratched laminated shaet is stretched in at least one direction to form a fem. The fine cells in the A layer of the laminated polyeeter film according to the present invention can be produced in the afore-mentioned stretching process. Accordingly, it is required that the stretching is conducted under the suitable conditions which can produce the fine cells in a wall-controlled manner and can satisfy the requirements such as a strangit or dimensional stability of the laminated polyecter film. For this reason, the following blackethy-eirebhing method and heal-treating method are suitably used.

in the stretching process, the unstretched sheet is first stretched in one (longitudinal) direction as a drawing harperature of usually 78 to 150°C, perfectly 75 to 190°C and a draw ratio of usually 2.0 to 7 times, preferably 5.2 to 6 brees, Such a stretching may be conducted by using a roll-type or tenter-type stretching machine. Next, the longitudiratio of the stretching of the stretched in the direction (tenneverse direction) perpendicular to the preceding stretching draw tion at a cleaving temperature of usually 75 to 150°C, preferably 60 to 140°C and a draw ratio of usually 3.0 to 7 times, preferably 3.2 to 6 times to obtain a blackally oriented film. The latter stretching may also be conducted by using the tents-types stretching metadrine.

The stretching in each direction can also be conducted in two or more stages. Attenuatively, the elitre-mentioned

issest esched sharet our be subjected to a rimultaneous blockel bretching. Further, the blockelly-extected film may be restreethed in the tonglational (maintine) direction at a directing temperature of 110 to 180°C and a draw ratio of 1.05 to 2.0 times. In this case, various procedures such as heat setting before the longitudinal re-stretching, longitudinal relaxation after the longitudinal re-stretching, the tongitudinal stretching before or after the longitudinal re-stretching, or the file care be appropriately used. Similarly, the blockelly-stretching processes is explicitly as the transverse direction. In any case, if a preferred that a folial draw ratio of these stretching processes is adjusted such that a surface area of the limit of 15 to 40 times that of the unstratched sheet.

The hold treatment of the laminated polyester film may be conducted at 150 to 250°C for 1 accords to 5 minutes under the condition of an etongation of not more than 30 %, a limited shrinkage or a constant length. Alternatively, after the bisolid sticiching, the film may be further re-stratisted in the longitudinal direction at a drawing temperature of 110 to 150°C and a draw ratio of 1,05 to 2.5 times, and then subjected to the abore-restrioned heat-treatment. In this case, excess appropriate procedures such as here selling before the longitudinal re-stratistic profession after the longitudinal restrationing, time longitudinal stretching before or after the longitudinal re-stratching, or the like can also be endopted. Further, the sheet may be subjected to various surface treatments during the film-forming process, if

The laminated polywater film (i) according to the present invention can exhibit a reduced weight per a unit volume because a fine cell-containing layer is provided therein, and good cushioning property. Further, by such an arrangement that a releasely thin layer heating a high concentration of fluorescent withering agent is laminated over the fine cell-containing layer, the resultant laminated film can show a sufficient yellowness on a surface thereof. For this reason, expendity when the laminated the (I) according to the present invention is applied to image-receiving papers for various printers, images having a high quality can be formed thereon. Further, since the total amount of the fluorescent whitening agent can be effectively recluded, there is an advantage of lowering the production cost.

The taminated film (II) excording to the present Invention can also have a reduced weight per a unit volume because a time call-containing layer is provided therein. Purther, since the thickness of a polyreste layer, which is to be as farmated over a surface of the fine cell-containing layer and contains substantially no fine cells, is immediated as especific range deposing upon periods diameters of the dispersed particles in the unstraiched sheet, the surface contains thereof other be prevented short being adversely affected by the warriness or waviness due to the fine cells without damage to custioning property thereof. Furthermore, since the yellowness and the optical density of the laminated IIm (II) are adjusted appropriately, a fine and clear image quality can be achieved when the film is applied to an image-receiving property thereof.

Fix ther, the laminated film (III) according to the present invention can also have a required weight pur a unit volume because a fine cell-containing layer is provided therein. Further, since the fitickness of a polyeeter layer which is to be animitated over a surface of the fine cell-containing layer and contains substantially not fine cells, is limited to a specific range, it can be prevented without damage to the flaxibility of the invincted film (III), that surfaces of cast rolls or stretching rolls are solded by the line cell-containing layer in the production process. Expecially when the laminated film (III) is accided by the out-into read inclining rolls are solded to a mount for each crini, timeas having a list of qualific can be obtained.

## SXAMPLES:

The present overtion is described in more detail below by way of examples. However, these examples are only illustrative and not intended to constitute a limitation of the present invention and it is to be understood that other and further multications and changes can be made without departing from the sprits and the scope of the present inventors:

Innovientally, in Examples and Comparative Examples, 'part or parts' represents 'part or parts by weight'; the mail 4 flow index (MH) of orystatine polymopylene used was 10g/10 min; the average particle diameter of titenium oxide was 0.3 µm, "OB-1" (produced by Eastman Kodak Corp.) was used as a fluorescent whitening agent; and "SH-193" (produced by Torry Dow Coming Co., Ltd.) was used as a silliconse-based surfactaint.

Various parameters and properties described hereinafter were measured or avaluated in the following manner.

### (1) Intrinsic viscosity in (dl/d):

One grant of polysetter from which polymer components immiscible with Polyester and pigments were removed, was discovered in 100 at 0 is a mixed solvent comprising phenol and tetrachloroethane at weight ratio of 50:50. The intensor viscosity of the polysetter excitation was measured at 80°C.

## (2) Film density (n/sm²);

A papers sangle having a size of 10 cm x 10 cm was out from an optional portion of the film. The weight of the carried was required to patient of and the thickness thereof was measured by a recrumeter at optional 9 points thereof to obtain

#### EP 0 705 300 81

an average hiddress. The weight per unit volume of the sample was calculated from the weight and the average that ness measured above. Five different samples (number of measurements "1" - 5) were measured and the everage of the measured vehicles was calculated to obtain a film density, inclinately, in the case where the film had a plurality of layers, other the thicknesses of the respective layers were measured by a transmission-type electron microscope, a curfice stayer of the film was absorbed by a microform and the density of the surface layer as measured by a density gradient bub. Based on the thus-obtained density of the surface layer, densities of the other layers (mammeliate layers) were actually the surface.

## (3) Yellowness (B value);

The color tone (E., a., b) of the film was measured by a color analyzer ("TC-1800MKB-Model manufactured by Tolyc Densholu Co., Lid.) according to JIS Z-6722. The yellowness of the film was represented by the B value thereof. The larger positive (+) B value indicate a higher yellowness of the film was represented that the was evaluated by the eventure of the B values measured at those different points thereon.

## (4) Optical density:

A visual light was irradiated over the film and the intensity of light transmitted through the film was measured by a Macbeth duminometer "TD-904 Model". The measurement was conducted at the different points on the film and the coptical density of the film was determined as the average of the five measured values. The larger value of the optical density indicates that the film has a lower light benefitiance.

# (5) Average particle diameter of pigment and particle size distribution thereof:

The particle diameters of the pigment were measured by a centrifugal sedimentation-type particle size distribution measuring apparatus ("SA-CPS Model" manufactured by Shimazu Satatiansho Co., Ltd.). The particle distribution pigment particles having a cumulative volume fraction of 50 % in the equivalent epherical distribution was determined as the average particle dismeter.

# (6) Melt flow lostex (MFI) (g/10 min):

The melt flow index of the film was measured according to JIS K-6759(1901). The higher MIPI value inclinates a lower melt viscosity of the polymer.

## 35 (7) Evaluation for printebility by linear printer:

The film was cut into A4-size sheet on which characters were then printed by using a leaser printer CPC-PP1006/A Model" manufactured by Nicpon Elachtic Co., Ltd.). The characters printed on the sheet were visually observed to examine the clarity or definition of characters printed. The presence of voids and the occurrence of paper-jeroming upon printing. The results of the visual observation were classified into the following ranks:

- High quality.
- Slightly deteriorated but still practically usable.
- X: practically unusable

# (8) Thickness of respective levers:

The cross section of the film was observed by a fransmission-type electron microscope (TEA), Specifically, a small were blanded. The thus-obtained film was orthodded in an epoxy resin in which a frantening agent and an accelerating agent were blanded. The thus-obtained film was out into a place hashing a thirdness of about 200 nnt by an alternativement to form a sample for observation. A microphotograph of a cross-section of the sample was tales by a treasmission-type electron microscope (TH-3000) manufactured by Helach LLD, to measure the fritchnesses of the respective layers of this sample. In the measurement, the frantenission-type electron microscope was adjusted such that the accelerating voltage was 200 kV and the magnification was in the range of 10,000 to 100,000 times according to the thickness of business and the conduction of the sample. The thickness measurement was conducted at thisy different points of were larger the figher 10 values measured and lower 10 values measured were ignored and the remaining 30 values measured was development as the transhing 40 values measured was development as the values as the same of the transhing 40 values measured was development as the values as

## (5) Effects of reducing an emount of fluorescent whitening event (OR-1) used:

The concentrations of the fluorescent whitening agent (OB-1) totally added to raw metantials of the respective films were compared with each other. The films having a higher concentration of the fluorescent whitening agent than a refcence occentration "5" by weight" were marked with "C", while those having a lower concentration of the fluorescent whitening along that the reference concentration were marked with "C".

#### (10) Evaluation of orintability by color printer:

The tim was out into an A4-size sheet on which images were printed by a thermal transfer recording method by using a color printer (CX-S000 Model" menulactured by Sharp Corp.) The thus-obtained hard copy was visually conserved to exemine the image, concentration, the voids and the clarity or definition of images. The results of the visual characteristic were classified into the following ranks:

high quality.

8.6

- A: Slightly deteriorated but still practically useble.
- practically unusable.

# (11) Average particle diameter funt of dispersed polypropriete (PP) particles in unstretched sheet.

A cancel by chocking an orises section the soft was prepared in the same manurer as defined in the above item (5) end then dyed with nutherism tetracide. The microphotograph of the cross section of the sample, which was magnified by 500 to 3,000 lance, was taken by the transmission-type electron microscope ("H-8000" manufactured by Hitachi 1831, By taking the true-chitained ten microphotographs, the distribution of diameters of circles corresponding to the cross section of the dispersed PP particles was measured by an image-processing system ("Clasminate 50" manufactured by Lellar-Carotrige Corp.). The everage of the measured circle diameters was determined as an average particle diameter of the dispersed polypropriers particles.

## (17) Cerew Time systage surface roughness (Ptg):

The center line everage surface roughness (R<sub>c</sub>) of the film was measured by a universal surface measuring device 
("SE-SF" menufactured by Kosekis Keniyusho Co., Ltd.). The measurement was conducted 12 times every sample. The overences and uppermost measured values were ignored and the remaining ten measured values were falsed into consideration. The everage of the remaining ten measured values was determined as the everage surface roughness (R<sub>c</sub>) 
of the sample. The measuring conditions used were a radius of the stylus: 2 µm; a load applied: 0.09 gf; a measuring permit is 2 mm; and a cut-off value; 0.08 mm.

#### (13) Eveluidion of printability by video printer:

images were priviled by a thermal transfer recording method on the B layer of the terminated film by using a video printer (1522-P11VF metastischared by Sherp Corp.). The thus-obtained hard copy was visually observed to exemine the concentration of the images, the volds on the images primed and the clarity or definition of the images printed. The results of the visual charvetion were classified into the following ranks:

- high quality.
  - Slightly deteriorated but still practically usable.
  - X: practically unusable.

#### (14) Soil of sest rolls upon the film production:

The cast rolls were operated continuously for 5 days under the conditions defined in Examples hereinafter. Thereafter, the cast rolls were visually observed. The results of the visual observation were classified into the following tanks:

- Class surbon
- Accumulated solls on the surface.

#### (15) Suitability for a mount for seal orbit.

Debationing degree of the terminated film was visually observed and the flexibility thereof was evaluated by hand

feeting. The results were classified into the following ranks.

- Or high passitive
- Slightly deteriorated but still practically usable.
- X practically unusable.

## Comparative Example 1.:

16.7 % by weight of crystalline polypropytene, 2.5 % by weight of stanium oxide and 0.3 % by weight of the discombased surfactions were acided to 60.5 % by weight of polyethylens terephthelate having an intrinsic viscosity of 0.09 and then the mixture was uniformly blended to prepare a polyaster raw material 9;. Separately, 2.5 % by weight of titanium exists was added to 97.5 % by weight of polyethylene terephihalets having an intrinsic viscosity of 0.69 and then the mixture was uniformly blanded to prepare a polyecter raw material A<sub>1</sub>, incidentally, the shove-mentioned weight percompages of the respective components are based on the total weight of each of the raw materials, which is also applied 15 to the weight percentages appearing throughout the following Examples and Comparative Examples.

The respective raw materials were charged into apparate extructors and maked at 230°C. The thus obtained motion raw materials were introduced into a common die and melt-extruded through slif-like openings such that buter layers made of the raw material B, were taminated over opposite surfaces of an inner layer made of the new material A. The terminate was passed over a cooling drum maintained at 40°C to prepare a co-extruded unalitatived share having three layers made of two different raw materials. The unstretched sheet was stretched in the longitudinal direction at a drawing temperature of 85°C and a draw ratio of 3.4 times. Further, the uniaxially stretched sheet was stretched in the transversa direction at a drawing temperature of 110°C and a draw ratio of 3.2 times and then heat-treated at 230°C to 5 seconds to finally prepare a biguisity stretched lauringted film having a thickness of 50 µm and a density of 0.97 g/cm<sup>5</sup>. The thus-prepared laminated film was evaluated to determine various properties and characteristics thereof. The regults are shown in Tables 1 to 3. It was found that the isminated film had a high b value and therefore was deteriorated in image-receiving capability.

#### Example 1:

The same procedure for the preparation of the new material A<sub>2</sub> as defined in Comparative Example 1 was conducted except that the amount of transium oxide added was changed to 7.0 % by weight to prepare a polyester rate material C., Separately, 7.0 % by weight of titanium colds and 5 x 10°2 % by weight of the fluorescent whitening agent were added to 92.95 % by weight of polyethylene terephthaliste having an intrinsic viscosity of 0.69 and then the mixture was uniformly blended to prepare a polyester raw material O<sub>1</sub>. Successively, a blickielly stratohod laminated film having a three-layer structure of D-/C-/D, made of two different kinds of materials was prepared in the same manner as defined in Comparetive Example 1. The thus prepared laminated film was evaluated to determine various properties and characteristics thereot. The results are shown in Tables 1 to 3, it was found that the laminated film were excellent in image-receiving capability.

#### Comparative Example 2:

Film ecraps discharged during the preparation of the laminated film of Comparative Example 1 was fed into a twinscrew extruder and melt-extruded to propere reclaimed raw meterial X. Polyethylene terephthalate in the reclaimed raw material X had an intrinsic viscosity of 0.61.

44.05 %, by weight of polyeinylene rerephthalate having an intrinsic viscosity of 0.74 was uniformly blended with 40 % he weight of the reclaimed raw material X. 13 % by weight of crustalline polypopolene and 0.15 % by weight of the fluorescent whitering agent, and then with 2.5 % by weight of Banium coide and 0.3 % by weight of the Micone-Cased surfactant to prepare a polyester raw material E<sub>1</sub>. Separately, 7 % by weight of transmit oxide and 5.0 x 10<sup>-6</sup> % by weight of the fluorescent whitening agent were added to 92,95 % by weight of polyethylene tereptifished having an infinite viscosity of 0.69 and then the mixture was uniformly blended to prepare a polyecter raw material Ft. Successivally, a blexially stretched teminated film having a three-layer structure of F./E./F.; made of two different kinds of raw materials was prepared in the same manner as defined in Comparative Example 1. The thus prepared laminolaid film was evaluared to determine various properties and characteristics thereof. The results are shown in Tables 1 to 3 % was found met the faminated film was disadvantageous in the production cost because a large amount of the fluorescent whitehing 55 agent was used therefor, though it was excellent in image-receiving capability.

#### Example 2:

We by weight of the model-index rew material X and 13 % by weight of crystalline polypropylene, and then with 2.5 % by weight of thinkner code and 0.3 % by weight of the efiliation-based surfactants to prepare a polyprate rew meterial Cr<sub>2</sub>. Separation, 7 % by weight of the increase of the efficiency and the efficiency of the preparation of the property of the filter special content whitering agent were added to 52.0 % by weight of the polypratipular bergolithalists having an intrinsic viscosity of 0.08 and then the institute was uniformly blendard to present a polyprate raw meterial H<sub>2</sub>. Successively, a bleadily stetiched learnineads filth relating at three-layer surface of H<sub>2</sub>C<sub>2</sub>H<sub>2</sub>, made of two different kinds of raw materials was prepared in the same memora as defined conceptants becample 1. The thus-prepared faminated filth was evaluated to determine various properties and characteristics thereof. The results are shown in Tables 1 to 5. If was found that the faminated film was excellent in image-resolving consolitify.

## Comparative Example 3:

20 % by weight of the reclaimed new material X, 13 % by weight of crystalline polypropylene and 3.% by weight of the discontained state of the discontained state of the discontained state of 5.7 % by weight of polypropylene translational the infrariac viscosity of 5.7 and then the mictare was uniformly blended to prepare a polypeter raw material 1, Separately 1.0 x 10 % by weight of the Ruchescent whitening agent was accled to 99.9 % by weight of polypethylene terephthalate having an intrinsic viscosity of 0.09 and then the mixture was uniformly blended to prepare a polypeter raw material 3. Successively, a bioxidely stretched terminated film having a timee-layer structure of JyhJy made of two different kinds of raw material properties and eliminal to comparative Example 1. The through comparate a defined in Comparative Example 1. The throughput defining the film wise exclusively of blended to determine verious properties and chimater for comparative Example 1. The throughput of the properties are defined in Comparative Example 1. The throughput of the properties are defined to Comparative Example 1. The throughput of the properties and chimaterial configurations of the properties of the properties and chimaterial configurations.

## Comperative Example 4:

The same polyester raw material C<sub>2</sub> as prepared in Example 1 was used in this Comparative Example. Separately, \$% by weight of the fluorescent whitening agent were added to 84.95 % by weight of the fluorescent whitening agent were added to 84.95 % by weight of the property of 0.99 and then the mixture was uniformly blended to prepare a polyester raw material K<sub>2</sub>. Successively, a blexisally of softed flammatical flink having a three-layer structure of K<sub>2</sub>CC<sub>2</sub>K<sub>3</sub> material of the officers of the materials was prepared in the same manner as defined in Comparative Example 3. The thus-prepared familiaried flink was evaluated to intermine various properties and characteristics thereof. The results are shown in Tables 1 to 3. It was found that the terminated flink was deteriorated in image-receiving applicit.

## Comparative Example 5:

The narror polyweller raw materials D<sub>2</sub> as prepared in Example 1 was used in this Comparative Example. Separately, S for yweight of projections polypropoleme and 7.0 % by weight of titanium codes were added to 60 % by weight of polyweightens at temphithwiste having an intrinsic viscosity of 0.50 and then the moture was uniformly blanded to prepare a polycense raw materials L<sub>2</sub>. Successively, a biscosity sheriched feminated film faving a time-layer structure of 0.4,4,2/5 mission of two different winds of the materials and the second of the comparative temple 1. The Place-repared terminated film was evaluated to determine various properties and characteristics thereof. The results are student in 1820 to 3.1 was found that the laminated film was deletionated in mage-receiving capability.

## Comperative Example 6:

The same polyecter new material D<sub>1</sub> as prepared in Example 1 was used in this Comparative Example. Separately, 50 % by weight of crystaffine polyempytene and 7.0% by weight of titlanium oxide were added to 45 % by weight of polyenthylane temphishates having an instruse viscosity of 0.69 and then the instrume was uniformly blanded to prepare a polyector raw material M<sub>1</sub>. Successively, a biasidally atteinhed laminated film having a times-layer structure of D<sub>1</sub>M<sub>1</sub>M<sub>2</sub>, and to the ordinary blanded to determine various manner as defined in Comparative Example 1. The third-prepared laminated film was evaluated to determine various properties and characteristics thereof. The results for a bown in Tables 1 to 3. It was bound that the privinated film was determined in image-received in image-received capability.

85

Table 1

	Density (p/orr <sup>3</sup> )		Thickness of each layer (µm)		Content in film (% by wol(dit)	
***************************************	8 layer	A layer	8 layer	A layer	Bilayer TiO <sub>2</sub>	A layer PP
Comparative Example 1	1.44	0.92	2.5	48	2.5	16.7
Example 1	3.44	0.90	12.5	25	7	19.7
Comperative Example 2	1.44	1.05	2.5	45	7	19
Example 2	1.44	1.95	2.5	45	7	19
Comparative Exemple 3	1,40	0.95	2.5	45	G	16
Comparative Example 4	1.52	0.89	. 8.8	45	35	16.7
Comparetive Example 5	3,44	1.83	2.5	45	7	8
Comperative Example 6	1.44	0.58	2.5	48	7	50

Table 2

	Amount of "OB-1" access (10" % by weight)			Film properties		
	in B leyer	in whole layer	Effects of reducing amount of "O8-1"	b value of surface of 8 layer	Optical density of surface of B layer	
Comparative Exam-	Ø	8	*	-0.8	0.7	
Example 1	5	2.5	10	-2.8	8,0	
Comparative Exam- ple 2	5	14	×	-3.0	0.7	
Example 2	10	1.0	0	-3.2	6.7	
Comparative Example 3	٦	0.1	٥	-2.0	0.2	
Comperative Exam- ple 4	S	0.5	٥.	-2.5	1.0	
Comparative Exam- ple 5	š	0.5	0	-3.1	0.8	
Comparative Example 6	5	0.5	0	-3.4	0.5	

15

Table 3

	irrage-receiving napability					
***************************************	Concentration of image printed	Voids in image printed	Clerity of image printed			
Comparetive Enscripte 1	0	$\Diamond$	Х			
Exemple 1	0	0	0			
Comparetive Example 2	0	0	0			
Exerção 2	O ·	$\Diamond$	0			
Comparative Exemple 3	0	0	X			
Companilive Example 4	X	X	0			
Comperative Example 5	0	X	0			
Comparative Exemple 6	. X	X	0			

#### Exarocate 3

15 % by weight of crystalline polypropylana (PP) chipe, 2 % by weight of finanium oxide, 0.05 % by weight of the objectivenessel whitehing agent and 0.2 % by weight of the allocen-based outstants were added to 62.75 % by weight of polyprityriene temperatures also sharing an internot visposity of 0.50 and then the misture was unformly blended to prepare a polyastar raw material A<sub>2</sub>. Separately, 92.95 % by weight of the same polyethylane temperatures as osed above web uniformly blended with 7 % by weight of stantium oxide and 0.05 % by weight of the fluorescent whitening agent to prepare a polyastar raw material B.

The respective raw materials were charged into separate extruders and mellor at 250°C. The thus-oblighted motion are materials were furnished and common three-depend of the are materials and the links openings such that outer layers made of the raw material B<sub>2</sub> were laminated over apposite surfaces of an intermediate layer made of the raw material B<sub>2</sub>. The laminate was passed over a cooling drum maintained at 40°C and repidity cooled to prepare a co-cartrided unaterial replacement of the polyprophemo (PP) dispensed particles in the A<sub>2</sub> layer of the understoked sheet was measured. The measurement revealed that the average particle duratives themselves 8.0 um.

The unstretched sheet exas shelched in the feeding (longitudinal) direction at a dewing temperature of 85°C and a draw ratio of 9.4 times. Further, the unlaxially stratched sheet was stretched in the transverse direction at a disaving temperature of 110°C and a draw ratio of 3.2 times and time healtheated at 230°C for 5 seconds to prepare a blavially structured laminated film. The thicknesses of the respective layers of the thus-prepared laminated film were Bg/Ag/Bg = 2 sin4/6 sin/5 unlied to the character of the times of times of the times of the times of times of the times of times of times of the times of t

## Comparative Example 7:

The same procedure as defined in Example 3 was ponducted except that the thicknesses of the respective layers of the intrinsical film were changed to those shown in Table 4. Specifically, an unstretched sheet containing the polyphone (PT) depressed parkische having an exregage period diameter of 8.0  $\mu$ m in the  $\rho_{\rm L}$  payer thereof was prepared. The thus-pracesed unstretched sheet was stretched and heat-freeted to prepare a biavisity stretched laminated film. The thicknesses of the respective layers of the thus-prepared laminated film were  $B_{\rm c}/A_{\rm c}/B_{\rm c} \approx 20~\mu m/40~\mu m/20~\mu m$  and the desixty of the laminated film was 1.13 clore<sup>2</sup>.

## Compensive Example 8:

The terms procedure as defined in Example 3 was conducted except that the thicknesses of the respective layers of the terminated than were changed to those shown in Table 4. Specifically, an unswetched cheel containing the dispersion properties (PP) particles having an average particle diameter of 6.0 µm in the A<sub>2</sub> layer thereof was prepared. The three propared insteticities there was directed and heat-treated to prepare a bisidely stretched annual form the terminated film. The tricknesses of the respective layers of the trusprepared terminated film.

the density of the leminated film was 0.88 g/cm<sup>2</sup>.

## Example 4:

38

Film corage discharged during the preparation of the terminated film of Exemple 6 were ted into a bein-coraw and material X. Polyethytene terephthalate in the reclaimed raw material X had an intrinsic viscosity of 0.61.

65.18 % by weight of kingin polyethylene teraphinisate having an intrinsic viscosity of 0.69 was uniformly blashold with 20 % by weight of the ractainsed new material X, 13 % by weight of drystaline polyprophiene and 0.0 % by weight of the fluorescent whitening againt, both of which were the same as those used in Exempte 3, and then blanded with 1.6 % by weight of thisnium orbite and 0.2 % by weight of the sillicone-based surfactural to prepare a rare material composition C<sub>g</sub>. Separately, 7 % by weight of titanium orbite and 0.15 % by weight of the fluorescent whitening agent were actived to 92.65 % by weight of polyethylene tesphibilistic having an intrinsic viscosity of 0.65 and then the riskure was uniformly blanded to prepare a rare material composition D<sub>g</sub>.

The same procedure as defined in Example 3 was conducted except that the above-prepared rew material compositions were used. Specifically, the respective raw material compositions were mell-extruded from a three-layered discontinuous layers made of the traw material composition D<sub>2</sub> were laminated over opposition is uniforms-distal layer made of the raw material composition D<sub>2</sub>. As a result, a co-estruded unstratched sheet having three layers made of the two different raw material composition was prepared. The dispersed polypropylene (PP) purities, contained in the thermedutals layer of the unstratched sheet had an average particle diameter of 4.5 pm.

The unstretched sheet was stretched in the machine (longitudinal) direction at a drawing lamperature of 85°C and a variety are to 6.4 times. Further, the uniaxially stretched sheet was stretched in the transverse direction at a drawing temperature of 110°C and a draw ratio of 3.2 times and then heat-treated at 230°C for 5 seconds to finally prepare a blackally stretched larrierstated film. The thicknesses of the respective layers of the this-prepared laminated film was head. CSD, 25°C by 10°C by 1

## Comparative Exemple 9:

. The earne procedure as defined in Example 4 was conducted except that the thicknesses of the respective keyest learning the time that the short of the learning the size persed polyproplene (PP) particles beying an average perficiel diameter of 4.5 µm in the  $\mathbb{Q}_2$  layer threat of was propared. The thus-prepared unstratched sheet was stratched and heat-treated to propare a blastially stretched laminated film. The thicknesses of the respective layer of the film prepared laminated film were  $\mathbb{D}_2/\mathbb{Q}_2/\mathbb{Q}_2 \approx 15 \, \mu m/35 \,$ 

#### Comparative Example 10:

The same procedure as defined in Example 4 was conducted except that the thicknesses of the respective layers of the laminated film were changed to those shows in Table 4. Specifically, an unstantant activation sheet containing the dispersed polyproplere (PP) particles having an average particle dismeter of 4.5 pm in the C<sub>2</sub> layer thereof was prepared. The thus prepared unstratched sheet was strictled and heal-treated to prepare a blookally stretched laminated film. The thicknesses of the respective layers of the thus prepared laminated film were D<sub>2</sub>(C<sub>2</sub>/O<sub>2</sub> = 0.15 µm/35 µm/0.15 µm and the density of the laminated film were 0.99 g/cm<sup>2</sup>.

The leminated films prepared in Examples 3 to 4 and Comparative Examples 7 to 10 were measured and evaluated to determine various properties and characteristics thereof. The results are shown in Tables 4 and 5.

Table 4

	******	irsernediele leyer	Thicknesses of respective layers (µm) (B <sub>2</sub> /A <sub>2</sub> /B <sub>2</sub> ) or (D <sub>2</sub> /O <sub>2</sub> /O <sub>2</sub> )	Density (g/cm²)	
		Amount of reclaimed raw material blended (% by weight)	Average parti- de diameter of dispersed PP particles in unstretched sheet (µm)		
Example 3	15	0	8.0	2/40/2	0.88
Comparative Example 7	15	٥	8.0	20/40/20	1.13
Comparative Example 6	15	0	6.0	0.2/40/0.2	0.83
Example 4	18	20	4.5	1.5/35/1.5	1.00
Comparetive Example 6	13	20	4.5	15/85/15	1.20
Comparative Example 10	18	20	4.5	0.15/25/0.15	0.99

Table 5

			manage o				
	******************	Film properties		Image-receiving capability or printability			
		Optical density	Surface rough- nees Ra (µm)		Voids in image printed	Clarity of image printed	
Exemple 3	-3.2	0.6	0.15	0	0	0	
Comparative Example 7	-30	0.7	0.06	0	×	0	
Comparative Example 8	-3.2	C.8	0.39	X	0	0	
Example 4	-2.0	0.5	0.12	. 0	0	0	
Comparative Example 9	-27	8.0	0.06	O	X	- 0	
Comparative Example 10	-1.8	0.5	0.82	×	0	0	

## Example 5:

15

86

25

30

15

13 % by weight of crystalline polypropylene chips, 2.4 % by weight of fitanium oxide, 0.05 % by weight of the flucrescent withering agent end 0.1 % by weight of the ellicone-based surfactant were action to 84.5 % by weight of polvethylene tereprite elements in thining in intrinsic viscosity of 0.69 and then the mixture was uniformly blended to prepare a polyecter are material A<sub>2</sub>. Suparately, 2.4 % by weight of flamourn oxide and 0.05 % by weight of the flucroscent whit-

oning agent were ackied to 97.55 % by weight of polyethylene terephilhatete having an intrinsic viscosity of 0.66 and then the mixture was uniformly blended to prepare a polyether law material B<sub>2</sub>.

The respective raw materials were charged into separate extrusives and method at 290°C. The titus-obtained motion were materials were introduced into a common die and neith-accorded through sith-like openings such that outer layers made of the raw material fig. were terminated over opposite surfaces of an inner layer made of the raw material. Ap. The terminate was passed over it cooling forum maintained at 40°C and repidity cooled to prepare a co-accorded unstetiched steel their street having intended price layers made of two different two materials. The undirectives shared was streethed in the materials (ap. streethed) and the streethed in the materials (ap. streethed) and the streethed in the materials (ap. streethed) and then the transverse direction at a claw ratio of 3.4 times. Further, the uniablely extended in the transverse direction at a claw ratio of 3.4 times. Further, the uniablely extended in the transverse direction at a claw ratio of 3.4 times. Further, the uniablely extended in the transverse direction at a claw ratio of 3.4 times. Further, the uniable extended in 1.0°C and a claw ratio of 3.1 times and then heat-resided at 200°C for 5 seconds to finally prepare a cital-step stretched laminated film. The thicknesses of the respective layers of the thus prepared laminated film were By/Ay/Bo = 0.5 pm/100 pm/0.5 pm and the density of the laminated film was 0.98 gift.

## Example 6:

15

The same procedure as defined in Example 5 was conducted except that the thicknesses of the respective layers of the interest that were changed to \$54/kg/5 = 2.5 pm/100 jm/2.5 pm. The this-prepared biasistly-stretched izminated tilm has the density of the taminated film was 1.00 pc/cm<sup>2</sup>.

### Comparative Example 11:

The same procedure as defined in Example 5 was conducted except that the thicknesses of the respective layers of the laminated tim were changed to 8y/Ay/B<sub>2</sub> = 8.3 µm/83 µm/8.2 µm. The thus-prepared biasistly-stretched laminated film heal the density of the laminated film was 1.05 g/cm<sup>2</sup>.

## Comparative Example 12:

The same procedure as defined in Example 5 was conducted except that only the raw material for the A<sub>0</sub> layer was used and no B<sub>0</sub> layer was provided thereon, so that a bladally-stratched single-layered film having a thickness of 100 m and a density of 0.98 glorn? was propared.

#### Example 7:

Firm sorage discharged during the preparation of the laminated film of Exemple 5 wete field into a twin-soraw is extruder and meti-extruded to prepare reclaimed raw material X. Polyathytene tensphihalate in the reclaimed raw metiorial X had an intrinsic vesposity of 0.81.

64.46 % by weight of polyethylane terephthaliate having an intrinsic viscosity of 0.65 was uniformly blended with 25 5 by weight of the above-posseder electioned raw manerial X, 13% by weight of the same crystalline polyproplene as used in Example 8 and 0.04 % by weight of '05e-1" as a blace-scent whitening agent, and than with 2.4 % by weight of itentium oxide and 0.1 % by weight of the silicone-based surfactant to prepare a new material Cs. Separetaly, 2.4 % by weight of the fluorescent whitening agent were added to 97.55 % by weight of the fluorescent whitening agent were added to 97.55 % by weight of polyethylene terephthaliate having an intrinsic viscosity of 0.85 and then the modure was uniformly blended to prepare a raw material D<sub>5</sub>.

The same procedure as defined in Example 5 were conducted except that the above-prepared raw materials were need used. Specifically, the respective raw materials were material to that cuter layers made of the material of were laminated over opposite surfaces of an inner layer made of the raw material C<sub>b</sub>. As a result, a po-extructed unabsorbed sheet having three layers made of the two different raw materials was prepared. The unstracted to the two stretched in the machine (longitudinal) direction at a drawing temperature of 85°C and a draw ratio of 3.6 times. Further, the unitaristly exteched sheet was stretched in the transverse direction at a drawing temperature of 11°C and 30°C and a draw ratio of 3.1 times and then heat-freated at 250°C for Seconds to finally propare as bioselity stretched tensinated film. The thicknesses of the respective layers of the thus-prepared bioxidity stretched film was 1.00 pc.tm<sup>2</sup> 0.8 pm.10°C pm.05°C.

# Example &

55

The same procedure as defined in Example 7 was conducted around that the thicknesses of the respective layers of the leminated film were changed as shown in Table 8. Specifically, the thicknesses of the respective layers of the this-prepared blackably-stretched leminated film were  $D_y/C_y/D_y \approx 2.5 \ \mu m/100 \ \mu m/2.5 \ \mu m$  and the density of the taminated film was 1.52 g/cm<sup>2</sup>.

The bilacially strationed items prepared in Examples 5 to 9 and Companyive Examples 11 to 12 were measured and availabled to determine various properties and characteristics thereof. The results are shown in Table 8.

Table 6

1	intermed	iate Inyer	Thicknesses	Thickness	Density
	Amoent of PP blended (% by weight)	Amount of reclaimed raw material blended (% by weight)	of respective layers (µm) (B <sub>3</sub> /A <sub>3</sub> /B <sub>3</sub> ) or (D <sub>3</sub> /C <sub>3</sub> /D <sub>3</sub> )	ratio (T <sub>A</sub> /T <sub>E</sub> )	of A layer (g/cm³)
Example 5	3	0	0.5/100/0.5	100	0.98
Example 6	13	Ū	2.5/100/2.5	20	0.98
Comparative Example 11	13	O	8.3/83/8.3	3	0.98
Comparative Example 12	13	0	Single layer of 100 µm	~	0.98
Example 7	13	20	0.3/100/0.3	100	1.00
Example 8	13	20	2.5/100/2.5	20	1.00

Table 6-continued

	Film properties			Contamination of cast rolls	Suitability for sea	
	Yellowness (5 value)	Optical density	Surface roughness Ra (µm)	upon production	Delustering	Flexibility
Example 3	-3.5	0.7	0.37	0	0	0
Example 6	-3.5	0.7	0.15	0	Δ.	Δ
Comparative Example 11	-3.6	0.7	0.07	0	×	· ×
Comparative Example 12	-3.3	0.7	0.41	×	0	0
Example 7	-2.1	0.7	0.39	0	0	0
Example 8	-2.6	0.7	0.14	0		Δ.

# Claims

933

33

38

55

## A faminated polyester film comprising:

a time call-containing polyeeter firm comprising 55 to 95 % by weight of polyeeter and 5 to 45 % by weight of a thermsclassic resin, said lines cell-containing polyeeter tilm having a density of 0,40 to 130 yicm<sup>2</sup>, and at least one of surfaces of said fine cell-containing polyeeter film terminated as an outer most layer on at least one of surfaces of said fine cell-containing polyeeter film, eaking a density of not less than 0.40 yicm<sup>2</sup>.

 A terminated polyecter film according to claim 1, wherein seld thermoplastic resin is selected from a group consisting of polyethylane, polypropytene, polymethyl pertene, polymethyl butene, polyetyrene, polycerbonates, polyphenylene suffice and liquid crystal polyesters.

- A lamineted polyacter film according to claim 1, wherein said thermoplastic rasin is polypropylene having a mail flow index of 0,5 to 30 grams per 10 minutes.
- 4. A learningted polyveter film according to claim 1, wherein said another polyveter film contains not less than 9.0.1% by weight of a fluoreacent whitening agent, whose consentration is higher than that in the fine cell-containing polyvets film, and 0.3 to 30 % by weight of a white pigment based on the total weight of the another polyveter film, thu yellowness on a surface of said another polyveter film is root less than 0.3.
- A laminated polyecter film according to claim 4, wherein said white pigment has an average particle diameter of not more than 5.0 um.
- 5 6. A terminated polyester film according to claim 1, wherein the thickness of said another polyeeter film is represented by the formula (1):

- where T<sub>B</sub> represents a thickness of the another polyester film after stretching and d (µm) represents an average particle diameter of the dispersed particles of the thermoplastic resin, contained in an unstretched sheet.
- A laminated polyester film according to claim 6, wherein said another polyester film has a surface roughness R<sub>a</sub> of 9.08 to 0.30 µm and a yellowness of not more than +3.0 and a colical density of not less than 0.8.
- A laminated polyester film according to claim 1, wherein the ratio of the thickness of said fine cell-containing polyester film to the thickness of said another polyester film is represented by the formute (2):

- where T<sub>A</sub> represents a thickness of the fine cell-containing polyaster film and T<sub>B</sub> represents a total thickness of said another cell-said film.
- A laminated polyester firm according to claim 6, wherein the optical density thereof is not less than 9.3 and the yellowness thereof is not more than +9.6.
- 10. A larrifinated polyester film according to claim 8, wherein the amount of the writte pigment contained in the film out-containing polyester film is in the range of 0.5 to 20 % by weight, and the amount of the white pigment contained in the another polyester film is in the range of 0 to 20 % by weight.
- A terminated polyester film according to claim 1, wherein the thickness of the laminated polyester film is in the range of 20 to 250 jum.
- 12. A laminated polyecter film according to claim 11, wherein the thickness of said fine cell-containing polyecter film or not less than 20 % based on the total thickness of the laminated polyecter film.
- 13. A laminated polyester film ecounting to claim 1, wherein the polyester of said fine cell-containing polyester film comprises a binomatipolyseter comprising 40 to 95 % by weight of virgin Polyester and 5 to 60 % by weight of reclaimed polyester.
- 14. A laminated polyester film according to claim 13, wherein said reclaimed polyester is these discharged from a process of the production of the farmosted polyecter film.
- A laminated polyester film according to cleiro 13, wherein said blended polyester has an intrinsic viscosity of 0.45 to 0.72 when shaped into a film.
- 16. An image-receiving paper for a laser printer, comprising the laminated polyester film defined in claim. I
- 17. An image-receiving paper for a color printer, comprising the terminated polyeeter film defined in deline 4.

- 18. An image-receiving paper for a video printer, comprising the terminated polyester tilm defined in claim 6.
- 19. A mount for seel print, comprising the laminated polyegier film defined in claim 8.

28.2

38



# . EUROPEAN SEARCH REPORT

Application Number EP 97 10 3984

mallack.	Citative of decement with indicate of reference percent		Regressi to cisine	CLASSIFICATION OF DES APPRICATION SALCES
<	EP 0 360 201 A (DIAFO	IL CO LTD) 28 March	1-3.8. 11.12	832627/36
š		ne 14; claims 1-3.6 *	4,5,7, 18-19	
	* page 3, line 38 - l * page 5, line 20 - l			
(	EP 0 582 750 A (AGFA ) February 1994		1-3.5.6.	
١.	* page 2, line 18 - p claims 1,4-6,8-11 * * page 4, line 3 - li		4	
	* page 4, line 16 - 1			
<b>A</b>	DATABASE WPI Section Ch, Week 9138 Derwent Publications Class ASS, AN 91-2771 VDGCC22485	Ltd., London, GB;	1,2,18	
	XP062033442 8 JP 03 182 349 A [TO August 1991 * abstract *	RAY IND INC) . 8	***************************************	100399804 F80.04 68480380 Ga.CAS
A	DATABASE WPI Section Ch, Week 9122 Derwent Publications Class A89, AN 91-1592 XP002033443 & JP 93 093 595 A (NI April 1991 * abstract *	Ltd., London, GB; 24	4	
			arkoning and a second a second and a second	
	The present search report has been	shrand by for all claims  There of supplettes of the conce.	1	Exectors
	THE HAGUE	19 June 1997	Kar	setakis, i
X : per	CATEGORY OF CITED DOCUMENTS  riching relevant if taken slows  riching relevant if combined with months  content of the name category.	E : earlies pessent d softet the Elling t D : document clear	romment, ist pub date	Historic star, on a